



CHART2 NTCIP COMPLIANCE ANALYSIS

Edwards and Kelcey Technical Design Document for CHART2

A study of each vendors' NTCIP compliance for the NTCIP Driver to integrate into the CHART2 software system. The CHART2 software provides a series of interfaces for a DMS type Driver to interact with. The NTCIP is a set of standards developed by several interested bodies for Intelligent Traffic Systems. This document examines the NTCIP compliance of each vendor.

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Abstract

The following is a discussion that focuses on several points: (1) what CHART currently has in place, (2) NTCIP DMS compliance for each vendor, (3) identifying the Mibs and the roles of each Mib that are part of the NTCIP driver, and (4) the affect of areas not being implemented have on the NTCIP Driver. Edwards And Kelcey could implement a NTCIP driver to handle the mandatory requirements, however, there seems to be a lot of variation for the optional requirements.

The area of most concern for mandatory requirements is with the sign control conformance group. The "reset" method is one of the functionalities of the NTCIP. The "reset" method corresponds to the MIB object dmsSWReset, which is found in the sign control conformance group. Currently all of the signs do not accept all PMPP communication, although all SNMP MIB agents should. The issues surrounding the "reset" method can be avoided if all of the signs accept all PMPP communication. Most of the differences in the vendors' compliance appear to be in the status subconformance groups. All of the status subconformance groups are optional and could be emitted if needed.

Vendors

Vultron, Inc. meets the NTCIP compliance in all of the conformance groups. However, there are several conformance groups that have attributes that are supported but the hardware configuration of the VMS may differ as to how the objects are applied.

Skyline Products, Inc. meets the NTCIP compliance in all of the conformance groups with the exception to the SNMP Group, Sign Status Conformance Group and the Power Status Subconformance Group.

Daktronics, Inc. meet the NTCIP compliance in all of the conformance groups with the exception of Pixel Service Conformance Group, Lamp Error Status Subconformance Group and Fan Error Status Subconformance Group. The conformance groups that are not compliant are not mandatory Mib's under the NTCIP specification and are not applicable with the Daktronics, Inc. sign.

Infocite` International do not meet NTCIP compliance in the following conformance groups:

- SNMP Group
- STMP - Dynamic Object Persistence Parameter
- Security Node Conformance Group
- Pixel Service Conformance Group
- Auxiliary I/O Conformance Group
- Lamp Error Status Subconformance Group
- Fan Error Status Subconformance Group
- Sign Control Conformance Group
- Default Message Conformance Group
- Sign Status Conformance Group
- Temperature Status Subconformance Group

The groups listed above will affect the mandatory Mib's Security Node Conformance Group, Sign Control Conformance Group and Sign Status Conformance Group.

Required Methods

The sign protocol handlers inside the CHART system currently implement five methods. These five methods include, Blank, getStatus, reset, setConfiguration and setMessage.

"Blank"

This method blanks a DMS sign. All vendors meet the NTCIP compliance in the Message Table Conformance Group. The Message Table Conformance Group contains objects that support the DMS Table functions that are common to DMS devices. The following objects will be used from the Table Conformance Group to support the "blank" method:

- dmsMessageBeacon: Indicates if connected beacons are activated.

- **dmsMessageMultiString:** Contains the message written in MULTI-Language.

Although, Vultron meet the NTCIP compliance in the Message Table Conformance Group it does has an issue with one of the objects being used from the conformance group. The hardware configuration of the VMS may differ as to how the object **dmsMessageBeacon** is to be applied.

"getStatus"

The current status of the DMS is returned by the **getStatus** method. It will implement get and set methods to access and modify values of the status of a DMS. The **getStaus** method will be responsible for retrieve information such as: the current message on the sign, its beacon state, its current operational mode and current operational status. The following are the conformance groups that will cover items expected in the "status report":

Message Table Conformance Group

- **dmsMessageMultiString:** Contains the text of the current message written in MULTI-Language
- **dmsMessageBeacon:** Indicates if connected beacon(s) are activated when the associated message is displayed.
- **dmsMessageStatus:** Indicates the current state of the message. This state-machine allows for defining a message, validating a message, and freeing message use.

Sign Control Conformance Group

- **dmsControlMode:** Contains a value that indicates the selected control mode of the sign.
- **dmsMsgSourceMode:** Indicates the source that initiated the currently displayed message.
- **dmsMsgTableSource:** Identifies the message number used to generate the currently displayed message. This object is written to by the device when the new message is loaded into the **currentBuffer** of the Message Table.

Sign Configuration and Capability Conformance Group

- **dmsSignType:** Indicates the type of sign
- **dmsMsgBeaconType:** Indicates the configuration of the type, numbers and flashing patterns of beacons on a sign.

Vultron Incorporated is the only vendor that has any issues with the mib objects needed for the "getStatus" method. Vultron supports the object **dmsMessageBeacon** but the hardware configuration of the VMS may differ as to how these objects are applied.

Based on the current system used by CHART, it is easy to see the great disparity between the status information offered by various vendors. Each of the sign types reports back the status that is most relevant to that sign. Even if a vendor is NTCIP compliant, Edward And Kelcey is curious if the NTCIP information passed back to CHART II is as useful as the vendor-specific information. Some relevant information could be missed that is not provided for by the NTCIP standards. This is difficult to determine even with the available information.

"reset"

The reset method resets the DMS controller. The Sign Control Conformance Group is a mandatory

Mib that posses the object dmsSWReset. The PCMS and ADDCO CHARTII signs do not support the dmsSWReset object. Infocite` International is not NTCIP compliant for the dmsSWReset object. In the current CHARTII system, several vendors do not have any sort of reset on their signs. Even if one sign is NTCIP compliant, but did not have a hardware reset, it obviously could not be compliant for a CHART II software reset.

It might be possible to send a reset to all signs, but it is unknown how they will respond. It can be assumed that the signs will accept a reset command, as the SNMP MIB agent should accept all PMPP communication without a problem, however it may reject it as an unknown Object ID. This would require further software modifications. The following are the Conformance groups that would be used in the reset method:

Sign Control Conformance Group

- dmsSWReset: A software interface to initiate a controller reset. The execution of the controller reset shall set this object to the value 0.

Default Message Conformance Group

- dmsResetMessage: Indicates the message that is displayed after a Reset(either software or hardware) of the the device

"SetConfiguration"

The setConfiguration method sets the DMS configuration parameters that are mostly needed for formatting messages. The configuration information stored here would be: size of the sign in character and pixels, its name and location, how to contact the sign, the default message of the sign, and the owning organization. The following are the conformance groups that cover items necessary in setting a configuration:

Sign Configuration and Capability

- dmsBeaconType: Indicates the configuration of the type, numbers and flashing patterns of beacons on a sign.

VMS Configuration Conformance Group

- vmsCharacterHeightPixels: Indicates the height of a single character in Pixels.
- vmsCharacterWidthPixels: Indicates the width of a single character in pixels.
- vmsSignHeightPixels: Indicates the number of rows of pixels for the entire sign.
- vmsSignWidthPixels: Indicates the number of columns of pixels for the entire sign.

Message Table Conformance Group

- dmsMessageOwner: Indicates the owner or author of this row.
- dmsMessageBeacon: Indicates if connected beacon(s) are activated when the associated message is displayed.

Font Definition Conformance Group

- fontHeight: Indicates the height of the font in pixels.

Multi Configuration Conformance Group

- defaultJustificationLine: Indicates the default line justification for a message.
- defaultPageOffTime: Indicates the default page off time, in tenths (1/10) of a second.

- **defaultPageOnTime:** Specifies how long each page of a multi-page message should be displayed. The value is only used if the page on time is not specified in the MULTI string passed to the sign. The value is specified in tenths of seconds.

Default Message Conformance Group

- **dmsResetMessage:** Indicates the message that is displayed after a Reset(either software or hardware) of the the device

The following conformance group had an exception for a particular vendor:

The mandatory Mib Message Table Conformance Group contains objects that support the DMS Table functions that are common to DMS devices. All vendors meet the NTCIP compliance in the Message Table Conformance Group. Although, Vultron meets the NTCIP compliance in the Message Table Conformance Group, it does have an issue with one object. The hardware configuration of the VMS may differ as to how the object `dmsMessageBeacon` are applied.

"setMessage"

The `setMessage` method displays a message on the DMS sign. The set method is implemented to access and modify the MULTI-formatted message and beacon state values which make up a DMS message. The `setMessage` group is the core functionality of NTCIP and as such all vendors were compliant in this area. It should be noted that the CHART II DMS Message object is only a subset of the NTCIP `dmsMessageEntry` object. It does not support the entire list of MIB objects inside the `dmsMessageEntry`. Edwards And Kelcey believes that this is a significant point, because it implies that any new NTCIP driver may have to extend this class.

The following are the Message Table Conformance Group objects that make up the "setMessage" method:

- **dmsMessageMemoryType:** Indicates the memory-type used to store a message.
- **dmsMessageNumber:** Enumerated listing of row entries within the value of the primary index to this table.
- **dmsMessageMultiString:** Contains the message written in MULTI-Language.
- **dmsMessageOwner:** Indicates the owner or author of this row.
- **dmsMessageCRC:** Indicates the CRC-16(polynomial defined in ISO/IEC 3309) value created using the values of the `dmsMessageMultiString-` (MULTI-Message), the `dmsMessageBeacon-`, and the `dmsMessagePixelService` -objects in the order listed, not including the type or length fields.
- **dmsMessageBeacon:** Indicate if connected beacon(s) are to be activated when the associated message is displayed.
- **dmsMessagePixelService:** Indicates whether pixel service shall be enabled or disabled while this message is active.
- **dmsMessageRunTimePriority:** Indicates the run time priority assigned to a particular message.
- **dmsMessageStatus:** Indicates the current state of the message. This state-machine allows for defining a message, validating a message, and freeing message use.

Summary

As stated earlier most of the differences in the vendors' compliance appear to be in optional conformance groups. Choosing anything other than the mandatory compliance driver could lead to a fractured set of mini-NTCIP drivers with special extensions. Any problems surrounding mandatory conformance groups can be avoided if the sign supports PMPP communication. Although the full compliance will not be known until the driver is implemented, the information presented in this report should provide SHA with the necessary information to choose which vendor and options that will best suit its needs.

Resources

- CHART2 : <http://www.chart.state.md.us/>
- Edwards and Kelcey Technology : <http://www.ekcorp.com/>
- NEMA : <http://www.nema.org/>
- NTCIP : <http://www.ntcip.org/>

References

- Edwards and Kelcey Report Subtask 1 : NTCIP Compliance Survey and Driver Development. 2001.
- Edwards and Kelcey Report Subtask 2 : NTCIP Driver High Level Design. 2001.
- MSHA Report : CHARTII Release I, Build 2 - GUI Detail Design.
- MSHA Report : CHARTII Release I, Build 2A - High Level Design.
- NEMA Standards Publication 1203-1977 : NTCIP Object Definitions for Dynamic Message Signs (DMS)